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RUNNING HEAD: Neighbourhood deprivation and quality of life

**On the street where you live: Neighbourhood deprivation and quality of life among
community-dwelling older people**

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Abstract

It is well established that neighbourhood quality is related to various aspects of people's health and coping, especially in old age. There have also been a few reports on the links between self-reported neighbourhood quality and quality of life in older age. However, it is not clear which aspects of quality of life in particular are related to neighbourhood quality and whether these associations are independent of the roles of cognitive, socioeconomic or health status, or rating biases. Using a large sample of Scots from the Edinburgh area (N = 1091, of whom 548 were men) aged between 68 and 71 years, this study shows direct associations of objectively and comprehensively determined neighbourhood deprivation with self-perceived quality of life in physical and environmental domains ($\beta = 0.07$ and 0.16 , $p < 0.001$), but not in psychological or social relationship domains. In a path model, these associations were independent of the roles of childhood cognitive ability and change in it to age 70, educational attainment, and occupational social class. The count of adverse health conditions (cardiovascular disease, stroke history, high blood pressure, diabetes, or arthritis) was associated with both quality of life and neighbourhood deprivation, and mediated the indirect links from neighbourhood deprivation to physical, psychological and environmental domains of quality of life. It is concluded that the neighbourhood in which older people live plays a role in one of the most important outcomes—how satisfied they are with various aspects of their life including physical functioning.

KEYWORDS: neighbourhood deprivation; quality of life; well-being; ageing.

Introduction

As the proportion of older people is growing rapidly in many societies, it becomes increasingly important to learn about the correlates of quality of life (QOL) in old age. This study examines the associations between objectively determined neighbourhood deprivation and four different aspects of QOL: physical, psychological, social (concerning relationships), and environmental. Neighbourhood deprivation summarizes the quality of various social and physical aspects of one's immediate neighbourhood.

There are several arguments for considering that neighbourhood deprivation might be linked with these domains of QOL in ageing people. First, neighbourhood deprivation has been associated with various aspects of physical health in older people (Yen, Michael, & Perdue, 2009), driving the possible association between neighbourhood deprivation and the physical aspect of QOL. In particular, older people living in deprived areas, when compared with people living in less deprived areas, are more likely to experience cardiovascular disease (Smith, Hart, Watt, Hole, & Hawthorne, 1998), pain that interferes with daily activities (Jordan, Thomas, Peat, Wilkie, & Croft, 2008), impaired mobility (Lang, Llewellyn, Langa, Wallace, & Melzer, 2008), long-standing illness (Smith, Olatunde, & White, 2010), and poor health in general (Cagney, Browning, & Wen, 2005). Also, area-based deprivation is associated with poor cognitive functioning in older people (Basta, Matthews, Chatfield, Brayne, & MRC-CFAS, 2007; Lang et al., 2008). Second, living in deprived areas has been linked to poor functioning in various aspects of daily living such as home management, self-care and social interactions (Breeze et al., 2005), possibly leading to a link between neighbourhood deprivation and the psychological and social domains of QOL. Third, there are associations between neighbourhood deprivation and symptoms of emotional disorders such as depression and anxiety in old age (e.g. Kubzansky et al., 2005; Ostir, Eschbach,

Markides, & Goodwin, 2003), although this is not a consistent finding (e.g. Walters et al., 2004; Wight, Cummings, Karlamangla, & Aneshensel, 2009). This again points to possible links between neighbourhood deprivation and the psychological domain of QOL. It seems plausible that the association between neighbourhood deprivation and QOL may be stronger in old age when people spend more of their time at home and may be more dependent on locally-provided and community-based resources such as health care or other forms of assistance (Yen et al., 2009).

To date, there have been few reports directly addressing the associations between neighbourhood characteristics and self-perceived QOL. In the English Longitudinal Study of Ageing, Webb et al. (2011) found that self-reported quality of neighbourhood (the sum of nine items asking about perceived vandalism, trust, support and other aspects of local environment) at baseline was associated with higher QOL four years later (measured using CASP-19, which summarizes perceived control, autonomy, pleasure, and self-realization; Hyde, Wiggins, Higgs, & Blane, 2003). In addition, changes in neighbourhood quality were positively associated with changes in QOL ratings over time (Webb et al., 2011). Wiggins et al. (2004) likewise reported an association between self-reported neighbourhood deprivation and perceived QOL (CASP-19) in older people. Consistent with this, Breeze et al. (2005) found that high area-based deprivation was related to low morale as captured by the Philadelphia Geriatric Centre Morale Scale, a self-report measure assessing agitation, attitudes towards ageing, and loneliness-related dissatisfaction (Lawton, 1975). However, the association was substantially reduced after adjustment for residency length, physical health, smoking and alcohol use. Of note is that the QOL measures used in these studies have addressed predominantly psychological aspects of the phenomenon. In contrast, some operationalizations of QOL—such as the WHOQOL measure used in this study—differentiate between multiple domains of the phenomenon.

To enhance the literature on this important topic, the present study tested the hypothesis that neighbourhood deprivation is associated with various aspects of QOL in older people. In brief, the rationale for the present study is based on a comprehensive and multi-faceted operationalization of QOL (as not all aspects of perceived QOL may be associated with neighbourhood deprivation in the same way), objective measurement of neighbourhood deprivation (to diminish the possibility of confounded associations resulting from general rating biases that could simultaneously affect ratings of the aspects of neighbourhood and QOL), and the inclusion of several important covariates that could confound or mediate the associations. In particular, it was reported for the same sample used in this study that higher life-long trait scores on cognitive ability tests (originally measured in childhood), better education and higher social class all contributed independently to living in less deprived neighbourhoods in older age (Johnson, Gow, Corley, Starr, & Deary, 2010). These variables have sometimes also been associated with perceived QOL in old age (Bain et al., 2003; Seymour et al., 2007; Brett, Gow, Corely, Pattie, Starr, & Deary, 2011) and therefore it was preferable to control for them when analyzing neighbourhood deprivation-QOL associations. Childhood cognitive ability was the only early-life variable used in this study because other relevant childhood characteristics such as parental socioeconomic conditions and neighbourhood deprivation were not directly associated with neighbourhood deprivation in this sample (Johnson et al., 2010). A broad measure of physical health (number of common adverse health conditions) was tested as a possible mediator between neighbourhood deprivation and quality of life, as suggested by Breeze et al. (2005).

Method

Participants

Participants are members of Lothian Birth Cohort 1936 (LBC1936), a follow-up sample of the participants of the Scottish Mental Survey 1947 (SMS1947; Deary, Whiteman, Starr, Whalley, & Fox, 2004). The SMS1947 participants comprised nearly all children born in 1936 who were at school in Scotland ($N = 70,805$). In the SMS1947, they were tested with a general cognitive ability test in 1947 when they were about 11 years old. For a study on cognitive ageing and health, surviving participants of the SMS1947 living in Edinburgh, Scotland, and its surrounding areas were recruited into the LBC1936 between 2004 and 2007 (Deary et al., 2007). Initially, 3,686 potential participants of SMS1947 were identified and sent invitations to take part in the planned study. Finally, 1,091 people (548 males), aged 67.7 to 71.3 years (mean = 69.6, $SD = 0.80$) at time of assessment (hereafter referred to as age 70), both agreed and were eligible to participate in the study. All participants lived independently in the community. Ethics permissions for the study were obtained from the Multi-Centre Research Ethics Committee for Scotland (MREC/01/0/56) and from Lothian Research Ethics Committee (LREC/2003/2/29). Full details on the background of the study, recruitment process, measures, and procedures are available elsewhere (Deary et al., 2007). Here, only those measures that are relevant to the hypotheses tested in the present study are described.

Main measures

Quality of life. QOL was measured with the WHOQOL-BREF (Skevington et al., 2004; World Health Organization, 1998). This is a shorter version of its parent measure, the WHOQOL-100. This widely used shorter measure consists of 26 items that are grouped into four major domains of life quality: physical (7 items), psychological (6 items), social (3 items), and environmental (8 items). The physical domain of the QOL summarizes people's

satisfaction with their physical functioning (having good sleep and enough energy, getting around, being able to work and carry out daily activities). The psychological domain questions people about the presence of negative feelings, their satisfaction with themselves and their appearance, meaningfulness of life, and the ability to concentrate. The social domain assesses satisfaction with personal relationships. The environmental domain assesses perceived safety and healthiness of the environment, access to necessary information, health services, leisure activities and transport, and financial opportunities. The items are rated on a five-point scale (1 to 5). The WHOQOL-BREF subscales scales have adequate internal consistency and have been validated in older populations (Hwang, Liang, Chiu, & Lin, 2003; Skevington et al., 2004). The domain scores were calculated as average items scores.

Neighbourhood deprivation. The Scottish Index of Multiple Deprivation (SIMD; Scottish Executive, 2006) provides an objective, standardized and comprehensive measure of neighbourhood deprivation throughout Scotland. It is an aggregate measure that ranks 6,505 data zones of Scotland on the basis of 37 neighbourhood-related indicators across 7 domains: average income, employment, health, education, skills and training, housing, geographic access, and crime. Scottish data zones are small geographical areas, with a median population size of 769. Participants' postcodes were used to link their current address with the corresponding 2006 SIMD ranking. The original distribution of the SIMD values was skewed towards higher rankings in the present sample. In order to make the distribution more meaningful, Johnson et al. (2010) recoded the original SIMD rankings for the present sample into an eight-point scale ranging from most deprived (1) to least deprived (8). It is stressed that, similarly to original SIMD values, low values indicate higher deprivation, whereas higher values indicate less deprivation in the present study.

Covariates

Cognitive ability. The participants took the Moray House Test no. 12, a group-test of general cognitive ability, twice, at ages about 11 and 70 years. This well-validated, 45-minute time-limited test includes various types of mental tasks such as word classifications, proverbs, arithmetic, spatial items, and others (for a more detailed description see Deary, Whalley, & Starr, 2009). At both testing occasions, raw scores were adjusted for age at time of testing and converted to IQ-type scores with mean of 100 (standard deviation of 15). Both childhood and older age cognitive ability scores were used as they summarized the life-long trait of cognitive ability (i.e., the baseline level and the change in it between the testing occasions).

Education. Highest level of educational attainment was recorded using five categories ranging from ‘no qualification’ (0) to ‘degree’ (4).

Social class. Occupational social class prior to retirement was captured on a six-point scale ranging from manual labour (5) to professional (1) (Office of Population Censuses and Surveys, 1980). In the present study, the scale was reversed so that higher values indicated higher social class. Females who reported a higher occupational social class for their spouse than themselves were classified according to their spouse.

The number of diseases. The total count of five self-reported common health conditions—cardiovascular disease, stroke history, high blood pressure, diabetes, and arthritis—was used as an index of general health.

Analytical procedures

First, the bivariate relationships between study variables will be presented (Table 1).

However, because the predictors of QOL were expected to be strongly intercorrelated, their multivariate associations with QOL would probably have appeared different from the

bivariate associations. In order to analyze the multivariate associations, a path model was constructed. Because there were no reasons to omit any combination of relationships, all possible associations were estimated in the model; that is, the model was saturated with zero degrees of freedom, which made model fit indices irrelevant. In the model (Figure 1), all variables were first regressed on sex (for simplicity, this is not shown on the figure). It was a life-course model in the sense that there were variables characterizing very different periods of life from childhood to older age and the associations between variables were specified accordingly. The variables measured at older age were regressed on age 11 cognitive ability because higher life-long trait of cognitive ability (for which childhood ability is a marker) is widely reported to be associated with relative advantage in several aspects of later life either directly or via its associations with educational and occupational attainments (Strenze, 2007; Deary & Johnson, 2010). Maximum educational attainment and occupational social class were also regressed on age 11 cognitive ability as these two characterize subsequent periods of life and are argued to be, to some extent, the outcomes of pre-existing levels of ability rather than its causes or simply co-variables (Deary, 2007; for a discussion see Deary & Johnson, 2010). Every other variable except age 11 cognitive ability was regressed on educational attainment and all variables except for age 11 cognitive ability and educational attainment were regressed on occupational social class. This means that all variables measured at age around 70 years were individually adjusted for their possible associations with childhood cognitive ability, educational attainment, and social class.

Next, the four domains of QOL were specified as dependent variables (regressed on all other variables) and were allowed to be inter-correlated. Finally, the remaining three variables—neighbourhood deprivation (SIMD), disease (count of five common health conditions) and age 70 cognitive ability—were specified as both dependent and independent variables: they were regressed on age 11 cognitive ability, educational attainment and occupational social

class to adjust for the possible contributions of these variables, and they were also viewed as potential predictors of the four domains of QOL in order to test the hypotheses that QOL is associated directly and indirectly via physical health with neighbourhood deprivation .

Regressing QOL variables on age 70 cognitive ability allowed us to adjust completely for the association between life-long cognitive ability and QOL. It is noteworthy that, because the cognitive ability scores at age 70 were regressed on childhood cognitive ability, in the path model the latter reflected people's relative change in cognitive ability from age 11 to age 70. In this model, although it is acknowledged that the physical health condition may have affected people's choice of neighbourhood, disease was regressed on neighbourhood deprivation in order to: a) adjust disease for neighbourhood deprivation; and b) be able to estimate formally the indirect associations between neighbourhood deprivation and the QOL domains. Because the purpose of the model was to test the associations between neighbourhood deprivation and QOL, net of the possible contributions from the other relevant variables, neighbourhood deprivation and disease were also regressed on age 70 cognitive ability to completely adjust them for life-long cognitive ability and its change (although it is acknowledged that both neighbourhood deprivation and disease may have also influenced cognitive change from age 11 to 70). All variables (including educational level, occupational social class, neighbourhood deprivation and disease burden, which all have ordered levels) were treated as continuous to provide most robust modelling approach, interpretation of the coefficients and ability to estimate formally indirect associations. The path model was implemented in Mplus 4.0 using maximum likelihood estimator.

Results

Descriptive statistics of the variables along with zero-order correlations between them, and sex differences in them, are given in Table 1. With respect to QOL, there was a clear pattern

of associations for its two domains: higher QOL in physical and environmental domains was significantly associated with lower neighbourhood deprivation, higher childhood and current cognitive functioning, educational attainment, occupational social class, and higher count of diseases (Table 1). In addition, higher scores on the psychological domain of the QOL were significantly associated with higher social class, current cognitive functioning and lower number of diseases. The psychological and social domains of QOL were not related to neighbourhood deprivation. Men tended to have higher scores than women on the psychological but lower scores on the social domains of QOL. Importantly, lower neighbourhood deprivation (SIMD) was associated with the other correlates of QOL domains—high cognitive ability in childhood and at age 70, higher education and social class, and lower number of diseases—thereby pointing to possible confounding roles of these variables in the associations between neighbourhood deprivation and QOL.

A path model, showing the unique associations (i.e., all other relations being adjusted for) among the variables, may be seen in Figure 1. Physical and environmental domains of QOL had still significant direct associations with neighbourhood deprivation, albeit with reduced effect sizes ($\beta = 0.07$, $p < 0.05$, and 0.16 , $p < 0.001$) compared to bivariate associations (Table 1). This suggests that the associations had not been fully confounded or mediated by other variables such as cognitive ability and change, education and social class, or the number of diseases. Additionally, the physical and environmental domains of QOL were linked to the number of diseases with effect sizes that were similar to those that had appeared in bivariate analyses. Likewise, changes in cognitive ability from childhood to age 70 were associated with these two domains of QOL and the environmental QOL domain had a small positive association with higher social class. Higher social domain of QOL was associated with the age 70 cognitive ability relative to childhood cognitive ability and lower education. These

associations had not been significant as bivariate associations, and therefore only appeared when all other variables were held under control.

The number of diseases had significant paths from neighbourhood deprivation and educational attainment. As the number of diseases was specified as a possible mediator between neighbourhood deprivation and QOL, it was also possible to estimate the indirect associations between the neighbourhood deprivation and QOL. Indeed, there appeared significant indirect associations via the number of diseases from neighbourhood deprivation to physical ($\beta = 0.04$, $p < 0.01$), psychological ($\beta = 0.02$, $p < 0.05$) and environmental ($\beta = 0.01$, $p < 0.05$) domains of QOL. As a result, the physical and environmental domains of QOL had both direct and indirect (i.e. mediated) associations with neighbourhood deprivation, with the total effect sizes (direct plus indirect) being ($\beta = 0.11$, $p < 0.01$) and ($\beta = 0.17$, $p < 0.001$), respectively.

Discussion

This study showed that neighbourhood deprivation was associated with the perceived QOL in the physical and environmental domains. These relationships held despite various possible confounders. In particular, as it had been shown with this sample in an earlier report (Johnson et al., 2010), childhood cognitive ability (which reflects, to a substantial extent, individual differences in the life-long trait of cognitive ability; Deary et al., 2004), educational attainment and occupational social class all contributed to the deprivation of the neighbourhoods in which people lived at age 70 years. The fact that these correlates of neighbourhood deprivation were also related to physical and environmental aspects of QOL could have possibly created previously overlooked confounded or indirect associations between neighbourhood deprivation and QOL. The present study, however, suggests that

neighbourhood deprivation was also associated with QOL directly and independently of these covariates.

With respect to the link between physical domain of QOL and neighbourhood deprivation, an apparent explanation for the association would have been to assume that it was mediated by physical health. As reviewed above, there is substantial evidence that living in deprived neighbourhood is associated with poor physical health and it is also reasonable to assume that health-related QOL is influenced by actual physical health. Additionally, the neighbourhood deprivation index, SIMD, also incorporated some health statistics such as mortality rate, substance abuse, and number of emergency admissions to hospital (Scottish Executive, 2006), possibly creating some overlap in content. Also in line with this reasoning, it was observed that the number of diseases was by far the strongest correlate of physical QOL and it was also associated with SIMD. Indeed, the association between the physical aspect of QOL and neighbourhood deprivation appeared to be to some extent mediated by the number diseases that people had been diagnosed with. However, there was also a direct association between neighbourhood deprivation and the physical domain of QOL, and the direct link was stronger than the indirect association.

It is noted that the association between neighbourhood deprivation and physical domain of QOL was probably not caused by people living in more deprived neighbourhoods being generally more dissatisfied or distressed, thereby rating satisfaction with every aspect of their life lower than people in less deprived areas. Evidence for this is that the psychological domain of QOL—which would have most likely captured the general satisfaction—was not related to neighbourhood deprivation. It is also worthwhile to stress here that an objective measure of neighbourhood deprivation was used in this study, diminishing the possibility that the associations with neighbourhood deprivation might have occurred because of general

rating biases or general negative affectivity (or neuroticism) simultaneously affecting all types of subjective ratings (evidence for such a confounding association of neuroticism in neighbourhood quality-mental wellbeing associations was reported by Gale, Dennison, Cooper, & Aihie Sayer, 2011). Thus, the present study provides evidence that neighbourhood deprivation may veridically be associated with people's satisfaction with their physical functioning (having good sleep and enough energy, getting around, being able to work and carry out daily activities), largely over and above a number of adverse health conditions that people have.

The neighbourhood deprivation variable, SIMD, summarized average income, employment, health, education, geographic access to services, housing, and crime of the areas where the participants lived. It is likely that, for the physical functioning of older people, the last three of the mentioned neighbourhood aspects are the most relevant (apart from health itself). In particular, it is fairly easy to imagine poor access to services or high crime prevalence influencing older people's satisfaction with their ability to get around and carry out many daily activities such as shopping or going to the post-office, walking or taking care of grandchildren, or possibilities for peaceful sleep, for example. Likewise, poor housing conditions—living in a over-crowded and poorly heated home (Scottish Executive, 2006)—may interfere with the ability to carry out daily activities such as keeping the household in proper condition, washing or doing laundry, for instance. However, the present study used the general SIMD index, so there is no empirical support as yet for these three domains of SIMD being the most important for physical domain of QOL. In sum, it is believed that the relationship between neighbourhood deprivation and physical domain of QOL is nontrivial and theoretically meaningful, albeit not large in terms of effect size.

The observed association of the environmental domain of QOL and neighbourhood deprivation is perhaps theoretically less interesting. The environmental domain of WHOQOL-BREF summarized perceived safety, healthiness of environment, access to necessary information, health services, leisure activities and transport, and satisfaction with financial opportunities (World Health Organization, 1998). It is evident that the aspects of satisfaction overlap to some degree with the content of SIMD. That is, the environmental domain of QOL and SIMD measured to some degree the same phenomena—quality of physical and social environment—although from different perspectives (subjective perceptions versus objective statistics, respectively). Notwithstanding the overlap in content, it is encouraging and not trivial to have this *validation*: that objective neighbourhood statistics reflect in inhabitants’ subjective perceptions about their environment.

The lack of direct association between the psychological aspect of QOL and objective neighbourhood deprivation in these data is consistent with results of a previous study in which there was no independent relation between mental wellbeing in older people and objectively measured neighbourhood deprivation (Gale et al., 2011): people who reported more problems with their neighbourhood environment had lower wellbeing levels, but this was largely due to their heightened general neuroticism. This suggests that associations between self-reported quality of neighbourhood and psychological QOL (e.g. Webb et al., 2011; Wiggins et al., 2004) may, at least to some extent, be caused by common causes (confounders) such as general distress or neuroticism. Indeed, there is evidence that people with higher neuroticism are more likely to report low QOL (Hayes & Joseph, 2003) and they are also more likely to be unhappy with their neighbourhoods (Jokela, 2009). Despite the lack of direct association, there was a very small but significant indirect association between neighbourhood deprivation and psychological domain of QOL via the number of diseases.

The lack of association between social aspect of QOL and neighbourhood deprivation may show that objective neighbourhood characteristics are irrelevant for the quality of personal interaction, at least as measured by the WHOQOL instrument. Perhaps the social cohesion aspect of neighbourhood quality, not directly covered by SIMD, would be more important to QOL (Gale et al., 2011). Also, since the social domain was covered with only two items, it is possible that the measure was too specific to be able to associate strongly enough to broad variables such as neighbourhood deprivation (although it did associate strongly with other aspects of QOL; Table 1).

In addition to a relatively large sample, a multi-faceted measure of QOL, objectively determined neighbourhood deprivation and the ability to model the possible contribution of life-long trait of cognitive ability, an important strength of the study is using a path model to represent the relationships between the study variables. The path model allowed the explicit and formal presentation of all direct and indirect associations between the variables (although only the indirect contribution from neighbourhood deprivation to QOL were highlighted in the text, the effect sizes of indirect associations from age 11 cognitive ability, educational attainment and occupational social class can readily be calculated on the basis of Figure 1). For instance, instead of stating that inclusion of potential confounders or mediators reduced the association between neighbourhood deprivation and physical QOL by a certain percentage, it was possible to explicitly quantify the hypothesized direct and indirect associations along with their statistical significance. Of note is that to some researchers, the associations with the number of diseases may be interesting in their own right: for instance, the findings that it relates to three aspects of QOL (especially strongly to its physical domain), but is also uniquely influenced by educational attainment and neighbourhood deprivation. As a final strength of the study, the participants' narrow age range excluded the confounding roles of chronological age and cross-generational differences.

A limitation of the study is possible overlap between measures of neighbourhood deprivation and some questions in the QOL instrument. Importantly, however, the two phenomena were operationalized completely differently—through objective statistics and subjective self-reports, respectively. Next, it would also have been desirable to have more detailed information about particular aspects of the neighbourhood environment (e.g. mobility options), which would have allowed further understanding of the mechanisms of the observed associations. Finally, it is noted that the results may not be assumed to generalise beyond this particular geographical and age cohort, though these matters will be interesting to investigate in themselves.

To summarize, perceived satisfaction with life is central to successful ageing. This study showed that satisfaction with various aspects of life—as measured by four domains of QOL—can be linked to people’s cognitive ability as well as to physical health. However, over and above these associations, the objective deprivation level of the local environment is also independently associated with older people’s subjective satisfaction with physical function and environment. The ‘street where people live’ affects their quality of life.

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Figure Captions

Figure 1. A saturated path model specifying associations between four aspects of quality of life, neighbourhood deprivation, cognitive function, education and occupational social class. QOL = quality of life; Diseases = count of diseases (cardiovascular disease, history of stroke, high blood pressure, diabetes, and arthritis). Numbers represent standardized path coefficients. Only significant paths are shown (at least $p < 0.05$). The coefficients in *italics* are significant at $p < 0.01$ and the paths in **underlined bold face** are significant at $p < 0.001$. For simplicity, associations between the four aspects of quality of life are not given (all were correlated significantly, see Table 1). All variables were also regressed on sex but, for simplicity, the associations are not shown (bivariate relations can be seen in Table 1). To facilitate reading of the diagram, the paths directly related to the main study variables are indicated by stronger lines.